

# RE-EVALUATION OF THE EFFECTS OF MAN-MADE MODIFICATIONS ON GORDON CREEK BETWEEN 1887 AND 1973 AND ESPECIALLY AS REGARDS ITS FISH FAUNA

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## ABSTRACT

Gordon Creek, a tributary of the Maumee River in northwestern Ohio, was investigated by Meek in 1887, by Trautman 1929-38, by the personnel of the Ohio Division of Wildlife between 1954 and 1973, and by Trautman and Gartman in 1973. Dredging and ditching in this area were begun about 1850, continuing until the present, with major channelization occurring in 1935. Channelization, together with the effects of dams and pollution, has had a major effect on the fish species present in this stream.

The Central Mudminnow (*Umbra limi*), Grass Pickerel (*Esox americanus vermiculatus*), Goldenshiner (*Notemigonus crysoleucas*), Hornyhead Chub (*Nocomis biguttatus*), Mimic Shiner (*Notropis volucellus*), Tadpole Madtom (*Noturus gyrinus*), and Piraleperch (*Aphredoderus sayanus*) all require clean static or flowing water, rooted aquatic vegetation, sand and gravel substrates, and/or well-defined riffles and pools. These species have been largely reduced in population abundance or have been extirpated in part or entirely by the destruction of their habitats by channelization. In contrast, the Creek Chub (*Semotilus atromaculatus*), Common Shiner (*Notropis cornutus*), and Spotfin Shiner (*Notropis spilopterus*) are tolerant of a more or less uniform current flow, such as produced by channelization, and are therefore rather generally distributed and remain numerous. The Silverjaw Minnow (*Ericymba buccata*) and Johnny Darter (*Etheostoma nigrum*) were recorded in greatest numbers over gravel-sand substrates. The Carp (*Cyprinus carpio*), Fathead Minnow (*Pimephales promelas*), Bluntnose Minnow (*Pimephales notatus*), Common Sucker (*Catostomus commersoni*), Yellow Bullhead (*Ictalurus natalis*), and Green Sunfish (*Lepomis cyanellus*) occurred most numerous in undredged pools or in pools largely recovered from former ditching; these pools were with or without currents, undercut banks, fallen timbers and brush heaps, and had various types of substrates.

The Largemouth Blackbass (*Micropterus salmoides*), Bluegill (*Lepomis macrochirus*), Suckermouth Minnow (*Phenacobius mirabilis*), and Orangespotted Sunfish (*Lepomis humilis*), absent in 1887, have been inadvertently introduced or have invaded the area. In some sections, riffles and pools have become partially reestablished since the last channelization, resulting in isolated small populations of such species as the Orangethroat Darter (*Etheostoma spectabile*).

## INTRODUCTION

Recently channelization has aroused considerable public attention and criticism. The Ohio Department of Natural Resources, recognizing the possible effects of channelization on the flora and fauna of streams and their watersheds, realizes the need for adequate investigations to evaluate the long- and short-term effects on stream ecosystems and the Ohio environment as a whole. Obviously there is a definite need both for quantitative evaluations of the assets and liabilities of channelization and, if possible, for discovering sound management practices.

Stream ecosystems in Ohio have been undergoing man-related alterations for more than a century, some to a marked degree. Channelizing a stream is one of the most drastic modifications of an aquatic ecosystem. The general concept of channelization involves the straightening of a stream or the dredging of a new channel to which the stream is diverted. Its purpose is to minimize local flooding by shortening the distance traveled by the stream water and thereby moving floodwaters downstream more rapidly (Emerson, 1971, p. 325).

Wetland-draining, channel-dredging, and ditching have been practiced for centuries. In the Black Swamp of northwestern Ohio, Trautman (1957, p. 20) states that in 1850 this swamp "was about 120 miles long and averaged about 40

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miles wide, was still undrained except for isolated areas about its periphery. Activities greatly increased, so that by 1875 much of the swamp had been drained. By 1900, partly through the help given by county commissioners, all except isolated portions of the great swamp had been ditched, drained and tilled, and immense crops grew where a few years previously Muskellunges, Pikes and Sturgeons had spawned and their young had developed."

The original ditching and draining of the Black Swamp (fig. 1) was done in moderation and without the use of modern earth-moving machinery. This ex-

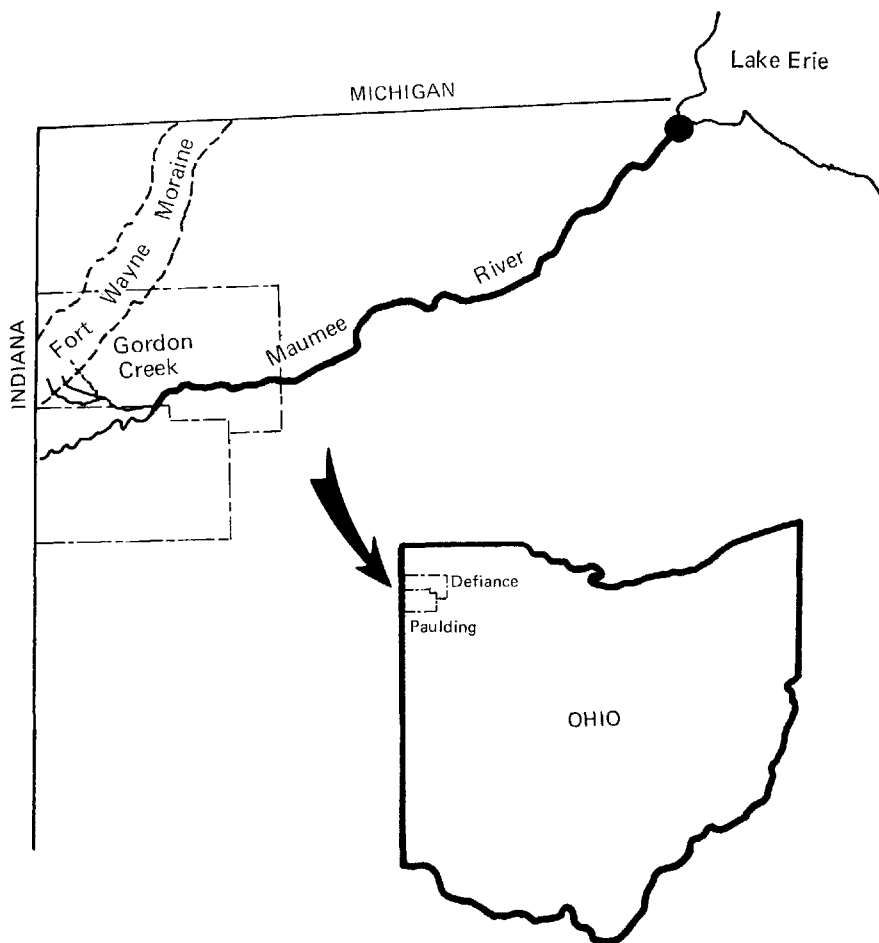


FIGURE 1. Ohio, location of Gordon Creek in Defiance and Paulding Counties.

tensive swamp of northwestern Ohio covered all or portions of 16 counties, including parts of Defiance and Paulding counties and also the area of Gordon Creek. Draining was essential so that economic agricultural production might be possible, and so that the area might be developed for human occupation. This amount of ditching and draining was largely beneficial, at least in the immediate area, greatly outweighing any disadvantages. However, it was not without some disadvantages. The Maumee River, which drained the Black Swamp, originally was an extremely important spawning ground for such commercial species as the Muskellunge (*Esox masquinongy*—Trautman, 1957, p. 215-17), Northern Pike (*Esox lucius*—

Trautman, 1957, p. 214), Lake Sturgeon (*Acipenser fulvescens*—Trautman, 1957, p. 154–55), Yellow Walleye (*Stizostedion vitreum vitreum*—Trautman, 1957, p. 526), Smallmouth Blackbass (*Micropterus dolomieu*—Trautman, 1957, p. 486–88), several species of suckers of the genera *Moxostoma* and *Catostomus*, and to a lesser degree, many other commercially important species, such as the Cisco (*Coregonus artedii*) and Whitefish (*Coregonus clupeaformis*). New conditions produced in the aquatic-environment by ditching and drainage have changed this.

Many of the streams in the Black Swamp carried a remarkably small silt load. Most of these streams had a very low gradient. Extensively flooded in spring, the potential sediment on this level land was “tied-down” by the vegetation of swamp forests and wet prairies. The best evidence that these streams had extremely low silt loads is the fact that they originally had many fish species highly intolerant to any degree of siltation, such as the Harelip Sucker (*Lagochila lacera*), which occurred in these streams until at least 1893 (Trautman, 1957, p. 263–265) and also elsewhere in eastern North America in streams noted for their former clarity. At present this species is presumed to be extinct. Other species now lacking, though preserved material is extant, are the Popeye Shiner (*Notropis ariommus*), Bigeye Shiner (*Notropis boops*), Blacknose Shiner (*Notropis heterolepis*), and Gilt Darter (*Percina evides*), all considered by ichthyologists to be intolerant of turbidity. These species have been eliminated not only from the now-turbid Maumee River and its tributaries, but also elsewhere in eastern North America from the majority of other streams which have become more turbid (also see Trautman, 1957, under these species). Increased turbidity, silt deposits on stream bottoms, and damming of the Maumee River have largely eliminated the Maumee River and tributaries as contributors to the production of fishes, thus decreasing the poundage of fishes captured annually in Lake Erie as food for human consumption (Hartman, 1972).

During the past 50 years, the senior author has observed many streams in Ohio before and after dredging and noted changes in fish populations of the streams involved. In many instances over-drainage of land adjacent to the channeled portions, increased sheet and gully erosion, and loss of fertile topsoil were noted. Rapid flushing of flood-waters downstream too frequently necessitated the building of dams to prevent further flooding. The loss of agricultural land as a result of impounding waters behind the dams in some instances appeared to remove more valuable land from needed cultivation than the upstream channeling had gained (see Trautman, 1957, p. 13–29).

It is generally agreed that moderate ditching and channelizing originally were necessary and were largely beneficial for agriculture. Unfortunately it is assumed by a few organizations and individuals that, because channelization was originally necessary and beneficial to man, further and more extensive channelization will likewise be more beneficial. The authors are convinced, from long-term observations and investigations of Ohio streams, that channelization is often not beneficial, but is sometimes harmful both to the stream ecosystem and to adjacent land areas.

#### GORDON CREEK

Gordon Creek is a northern tributary of the Maumee River and lies in Defiance and Paulding Counties of northwestern Ohio (fig. 1). It arises on the Fort Wayne End Moraine northwest of Hicksville, Ohio, drains a total of 42.65 square miles (110.44 km<sup>2</sup>), and is approximately 17 miles (27.4 km) in length (Ohio Division of Water, 1960). Except for a few sections, especially in the upper headwaters, the stream has been dredged and channeled, the last time extensively in 1935. Ancient stream meanders, cut off by channelization, form oxbows. Figure 2 (A–F) presents views of Gordon Creek in 1973. Since 1935, some residents have continued the practice of “ditch cleaning,” which involves periodic removal of sections of stream-bottom material and logs, and cutting of shore vegetation. The dominant agri-

cultural activity of the watershed area is the cultivation of soybeans, corn, and wheat. In addition, remnants of swamp forests, composed primarily of elm (*Ulmus sp.*), ash (*Fraxinus sp.*), and silver maple (*Acer saccharinum*), are present. Many sections of the streams are bordered by cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), and honey locust (*Gleditsia triacanthos*).

Gordon Creek was chosen for study because there exists a backlog of data extending from 1887 to the present. Meek (1889, p. 315-37) was the first to investigate this stream, an investigation that also considered the adjacent Maumee River and Lost Creek. Between the years 1929 and 1938, Trautman (1939, p. 275-88) attempted to duplicate Meek's work and to evaluate changes in both

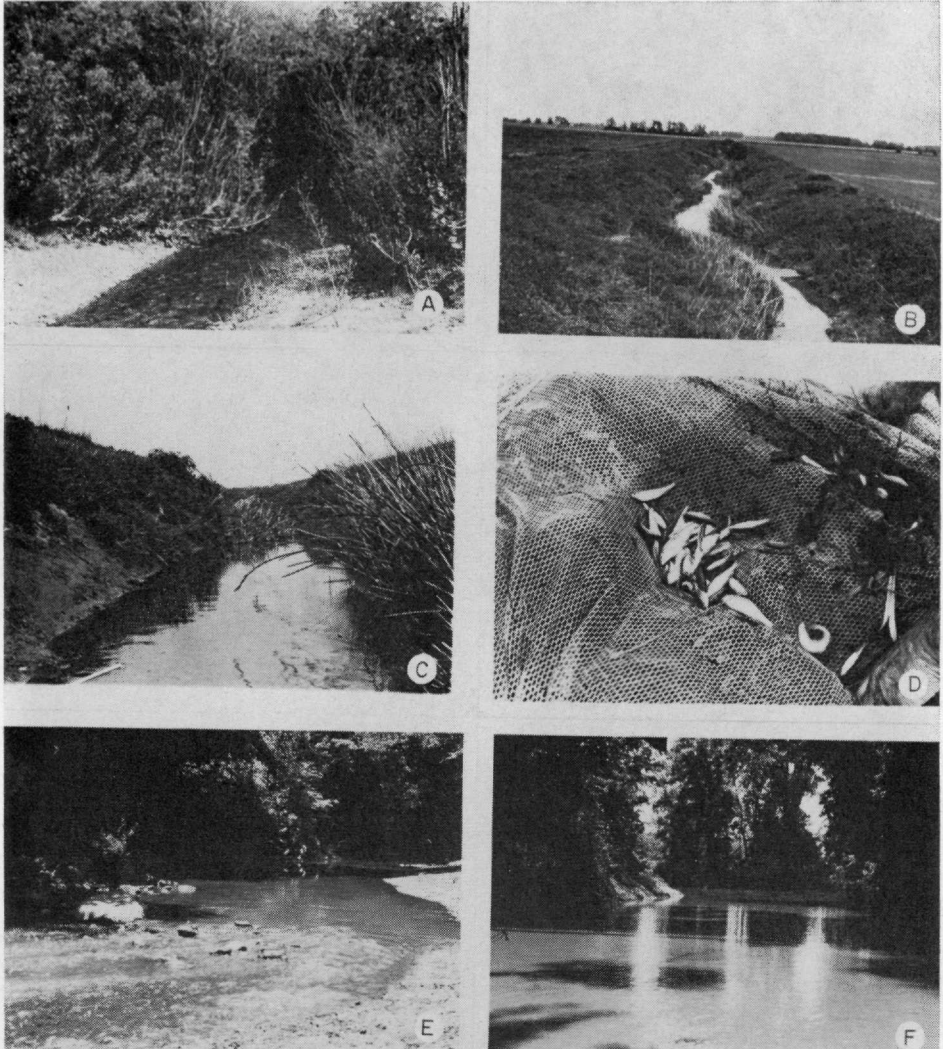


FIGURE 2. A, Undredged riffle below Hicksville, State Route 2 at Hicksville, May, 1973. B, Intensively maintained area immediately south of Lake Road. C, Same locality as B, showing vegetation. D, Seine haul from Lake Road area. A spawning concentration of minnows, May, 1973; note absence of food and game fishes. E, Beginning of riffle development near mouth. F, Confluence of Gordon Creek with the Maumee River; looking downstream beneath Coffin Road bridge.

undredged and dredged portions of Gordon Creek. It was found that the fish species and their numbers had changed comparatively little in undredged portions of the creek between 1887 and 1938, but that drastic changes had occurred in dredged portions in the numerical abundances of the fish species. In 1973 Trautman and/or Gartman spent 15 days in the field further investigating the fishes from both the dredged and undredged portions of Gordon Creek. These new data were then compared with Meek's work (1889), Trautman's 1938 study, and the Ohio Division of Wildlife's fish-collection results from 1954-1973. It is the results of this final comparison and the interpretations drawn from those results that are presented here.

#### METHODS

Fish sampling was done by seining in all three investigations. In 1889, Meek stated that, in his survey of 1887, "The seining was done with a small Baird seine" (1889, p. 435). The Baird seine contained no bag in the center, and was generally 4 feet in depth and 6 feet or longer in length. In 1938, Trautman used similar straight seines (comparable to those used by Meek), which were 4 feet in depth and 4 to 6 feet in length. In addition, a bag seine 5 feet deep and 20 feet long, containing a 5-foot-deep bag in the center, was employed sparingly in deep, long pools, such as at the mouth of Gordon Creek and in the deeper oxbows and meanders.

In 1973, Trautman and Gartman used the same types of seines as had been employed in 1938. The large bag seine again was used sparingly, and largely as a check. Thus the 1887, 1938, and 1973 methods of capture are all comparable.

Meek's 1887 seining stations had to be approximated in the 1938 and 1973 surveys, because of the lack of specific locality descriptions by Meek. Sampling sites for 1938 and 1973 are comparable, except in those instances where oxbows had been filled in with trash or drained and in those areas where recent ditching had been done. Each sampling station in 1973 was investigated four times between May and September. Sampling stations are shown on figure 3.

To conform with data presented in the 1889 and 1939 publications, the same abundance terms are used here to describe the frequency with which individuals of a single species were collected and the numbers recorded in a single locality. Admittedly these terms are only rough indicators of a species' abundance, but are needed if valid comparisons are to be made. The abundance terms used in both earlier publications and here and their definitions follow.

*Scarce*—Used by Meek in 1889 and believed to indicate the presence of two to several individuals; comparable to the 1939 and our present concept of *Rare*.

*Rare*—A species recorded only once or very infrequently, and invariably in small numbers.

*Uncommon*—Occurring rather regularly in collections, but usually only in small numbers.

*Common*—A species which, considering its catchability under various conditions and times, is found usually in moderate to large numbers.

*Very common*—A species which is readily catchable, usually in large numbers.

*Abundant*—A species so numerous as to be usually one of the dominant species collected.

#### RESULTS AND DISCUSSION

The results of the sampling by Meek (1887), Trautman (between 1929 and 1938), the Ohio Division of Wildlife (between 1954 and 1973), and by us (in 1973) are given in table 1. To help evaluate the significance of the abundance data presented in table 1, the general habitat requirements of some of the species are outlined in the following annotated list, together with some additional notes about the species occurrence in Gordon Creek. If further information concerning a species is desired, the book "The Fishes of Ohio" (Trautman, 1957) should be consulted, under that species.

The species sequence below follows that used by Van Meter and Trautman (1970, p. 65-78).

*Dorosoma cepedianum* (Lesueur)—Gizzard Shad

Meek (1889) recorded this species as "rather abundant" in the lower third of Gordon Creek in the vicinity of Cecil. In 1973, several adults and many young were taken near the stream mouth. Presumably, this species migrates upstream to spawn, as it does in other Maumee River tributaries.

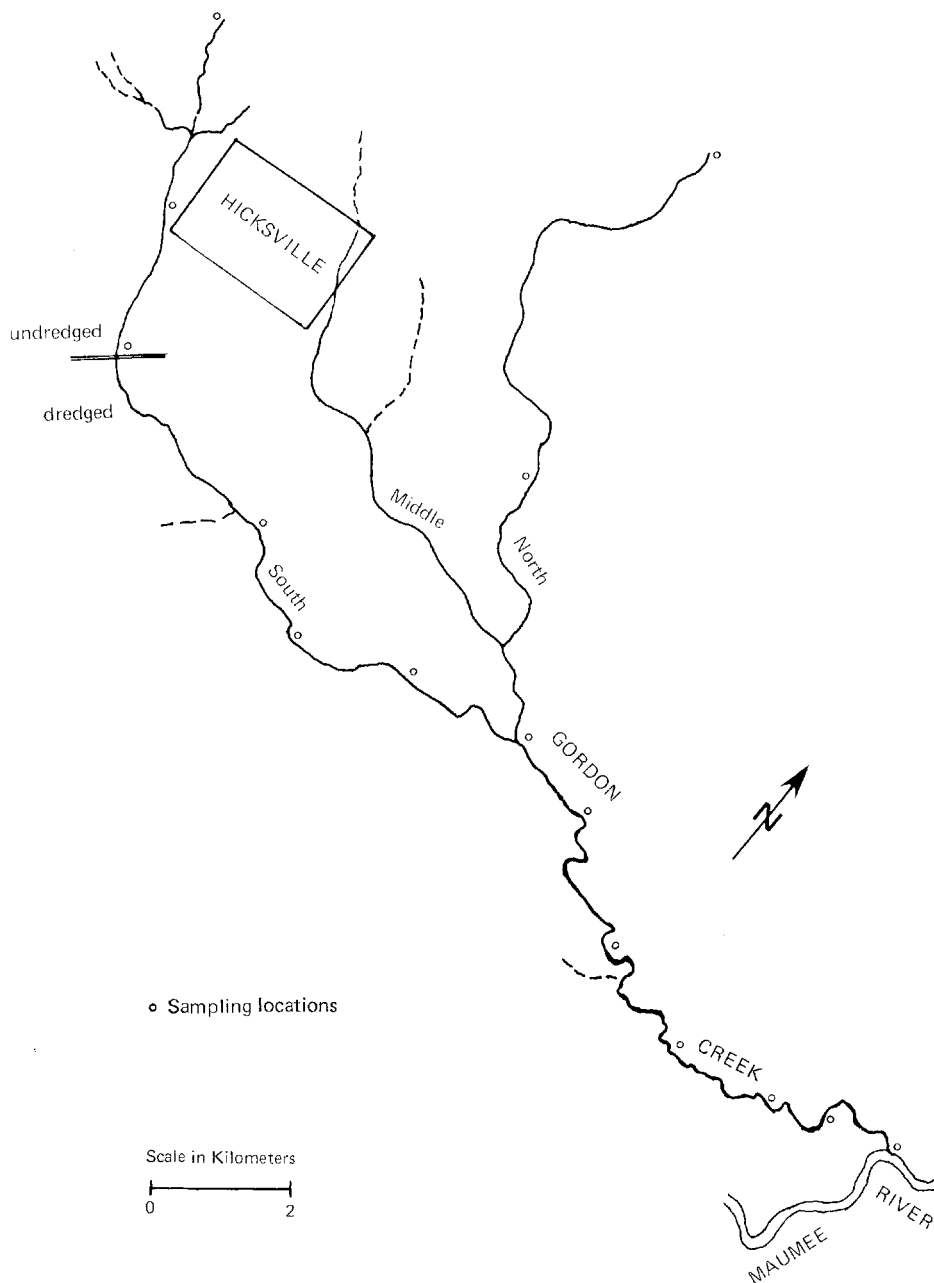


FIGURE 3. Principal sampling localities.

TABLE 1<sup>1</sup>  
*Relative Abundance of various fish species as recorded 1887-1973, Gordon Creek*

Species	1887 Meek undredged		1938 Trautman		1954-1973 Ohio Division dredged		1973 Trautman and Gartman	
	undredged	dredged	undredged	dredged	undredged	dredged	undredged	dredged
<i>Dorosoma cepedianum</i>	rather abundant near mouth	—	—	—	common at mouth	—	—	common at mouth
<i>Umbra limi</i>	rather common in small bayous	—	—	—	—	—	—	—
<i>Esox vermiculatus</i>	not very abundant	—	—	—	—	—	—	—
<i>Esox lucius</i>	—	—	—	—	—	—	—	—
<i>Cyprinus carpio</i>	—	—	a few young taken in a deep pool	—	common	—	uncommon	2 specimens common
<i>Carassius auratus</i>	—	—	—	—	—	—	1 specimen	—
<i>Notemigonus crysoleucas</i>	—	—	rare, only in oxbows or weedy pools	—	—	—	rare, 3 specimens in 2 locations	—
<i>Nocomis biguttatus</i>	abundant	—	common	—	—	—	—	—
<i>Semotilus atromaculatus</i>	abundant	—	common	uncommon	very common	very common	abundant	scarce
<i>Phenacobius mirabilis</i>	scarce	—	scarce or uncommon	—	not common	—	scarce	very common
<i>Notropis umbralis</i>	very abundant	—	uncommon	common	very common	abundant	abundant	common
<i>Notropis cornutus</i>	—	—	few	few	common	—	—	common
<i>Notropis spilopterus</i>	—	—	—	uncommon	very common	—	uncommon	uncommon
<i>Notropis stramineus</i>	not very abundant	—	—	—	—	—	—	—
<i>Notropis volucellus</i>	abundant	—	usually absent or scarce	abundant wherever sand is exposed	very common	uncommon	—	very common
<i>Ericymba buccata</i>	—	—	common to abundant	common to abundant	uncommon	common	common	common
<i>Pimephales promelas</i>	not abundant	—	generally distributed, usually common	generally distributed, usually uncommon	common to abundant	common to abundant	common to abundant	common to abundant
<i>Pimephales notatus</i>	abundant	—	1 specimen	—	—	—	—	—
<i>Campestris atromaculatus</i>	not very abundant	—	—	a few young	common	common	common	common
<i>Carpiodes cyprinus</i>	abundant	—	—	—	common	—	—	common at mouth
<i>Moxyostoma duquesnei</i>	—	—	young numerous in 1930	—	—	—	—	—
<i>Moxyostoma erythrum</i>	—	—	1 specimen	—	common	—	—	—
<i>Moxyostoma valenciennesi</i>	abundant	—	very common to abundant	—	abundant	—	1 specimen very common	—
<i>Catostomus commersoni</i>	—	—	abundant	—	uncommon to common	—	—	common
<i>Ministroma melanops</i>	—	—	—	—	—	—	1 specimen	—
<i>Erimyzon oblongus clausiformis</i>	scarce	—	scarce	—	—	—	—	uncommon
<i>Ictalurus natalis</i>	—	—	usually common in pools, abundant in oxbows	2 specimens: 1 found under old shoe, other under brick	common	common	common	common

<i>Ictalurus nebulosus</i>	very abundant	—	—	—	—	—
<i>Ictalurus melas</i>	abundant	uncommon or common	1 specimen	—	—	—
<i>Noturus flavus</i>	—	—	—	—	—	1 specimen
<i>Noturus gyrinus</i>	—	—	—	—	—	—
<i>Fundulus notatus</i>	—	common in undredged oxbow	2 specimens	—	common	common
<i>Aphredoderus sayanus</i>	1 specimen	—	—	—	—	—
<i>Pomoxis annularis</i>	—	a few	—	—	—	—
<i>Micropterus dolomieu</i>	—	—	—	—	—	—
<i>Micropterus salmoides</i>	—	—	—	—	—	—
<i>Lepomis cyanellus</i>	abundant	usually common, abundant in oxbows	a few	—	uncommon	uncommon
<i>Lepomis macrochirus</i>	—	—	—	—	common	common
<i>Lepomis humilis</i>	—	—	—	—	uncommon	uncommon
<i>Lepomis megalotis</i>	less abundant than <i>L. cyanellus</i>	—	—	—	uncommon	uncommon
<i>Lepomis gibbosus</i>	—	—	—	—	—	—
<i>Percina maculata</i>	not abundant	a few	—	—	rare	rare
<i>Percina caprodes</i>	—	—	—	—	rare to uncommon	rare to uncommon
<i>Etheostoma nigrum</i>	abundant	common where there is gravel	a few	—	common	3 specimens
<i>Etheostoma blennioides</i>	—	rare	—	—	—	common
<i>Etheostoma spectabile</i>	—	—	—	—	locally common	uncommon

This table presents the relative abundances of the fish species in Gordon Creek as reported by Meek in 1887, Trautman between 1929 and 1938, and the Ohio Division of Wildlife personnel between 1954 and 1973, and of Trautman and Gartman in 1973. Abundance terms used by all sources carry the same meaning and are defined in the text.

Although some ditching and dredging had occurred by 1887, we assume that Meek (1889) collected in the more or less undredged portions where the largest number of species and individuals could be obtained in the shortest period of time.

Additional comments about individual species are given in the text under Results, in which are described in what section of the stream and type of habitat a species was normally taken, its past and present scientific name, and other qualifying remarks.

The authors are indebted to Darrel Allison, the Ohio Division of Wildlife, for providing past records of Gordon Creek collections and for personal comments concerning our presentation of abundances of the various fish species in Gordon Creek.



*Umbra limi* (Kirtland)—Central Mudminnow

A species inhabiting springs or clear static waters having undisturbed muck and organic substrates; intolerant of turbidity and siltation.

*Esox americanus vermiculatus* Lesueur—Grass Pickerel

Usually an inhabitant of weedy and static habitats. Adversely affected and usually extirpated by increased stream flow and siltation, which destroy its habitat.

*Esox lucius* Linnaeus—Northern Pike

Two individuals collected at mouth of Gordon Creek where stream has recovered somewhat from dredging.

*Cyprinus carpio* Linnaeus—Carp

Largest numbers of both adults and young were taken from deeper and better developed pools and oxbows. First introduced into Ohio waters in 1889, this species quickly became established and now is distributed generally throughout Ohio waters (Trautman, 1957, p. 284).

*Carassius auratus* (Linnaeus)—Goldfish

Only specimen collected was a hybrid between this species and the Carp. The Goldfish had been liberated in Ohio waters by 1885 (Trautman, 1957, p. 285-87). It prefers aquatic vegetation and is less tolerant of turbidity, siltation, and flowering waters than is the Carp, so it is not so numerous or so universally distributed (Trautman, 1957, p. 287).

*Notemigonus crysoleucas* (Mitchill)—Goldenshiner

Chiefly an inhabitant of clear weedy static waters; intolerant of siltation, increased current, and other effects of channelization.

*Nocomis biguttatus* (Kirtland)—Hornyhead Chub

In 1887 this species and *Nocomis micropogon* (Cope) were not generally recognized as distinct species, the two being collectively known as *Hybopsis kentuckiensis*. Normally an inhabitant of clear slowly flowing riffles with a substrate of sandy gravel and usually with some aquatic vegetation. Disappearance of this Chub after 1887 was brought about by destruction of its habitat.

*Semotilus atromaculatus* (Mitchill)—Creek Chub

Taken at all collecting stations in 1973; most numerous in well-defined riffles and pools.

*Phenacobius mirabilis* (Girard)—Suckermouth Minnow

A recent invader, not recorded for Ohio waters until 1920 (Trautman, 1957, p. 323-25), and one that is rather tolerant of turbidity.

*Notropis umbratilis* (Girard)—Redfin Shiner

Essentially a pool and sluggish-riffle species; commonly present among aquatic vegetation, intolerant to recent dredging. Taken in 15 collections in 1973. Has a marked tendency to migrate upstream to spawn. The *Notropis lythurus* [sic] of Meek (1889).

*Notropis cornutus* (Mitchill)—Common Shiner

A few to large numbers taken at almost every collecting station. Tolerant to flowing waters and effects of moderate channelization. The *Notropis megalops* of Meek (1889).

*Notropis spilopterus* (Cope)—Spotfin Shiner

Recorded in about half of the 1973 collections. Tolerant to a moderate current, turbidity and siltation of the substrate, and enrichment by organic wastes, hence occurring in numbers in moderately channelized waters. The *Notropis whipplei* of Meek (1889).

*Notropis stramineus* (Cope)—Sand Shiner

Generally uncommon, taken in only 11 collections in 1973. Tolerant to flowing waters, which inhibit the settling of silt over the sandy gravel substrates. Not recorded by Meek (1889).

*Notropis volucellus* (Cope)—Mimic Shiner

Meek's detailed description (1889, p. 437) leaves no doubt that this inhabitant of clear slowly flowing waters with clean substrates was present in Gordon Creek near Cecil in 1887. Intolerant to channelization and increased stream flow. Not captured since 1887.

*Ericymba buccata* Cope—Silverjaw Minnow

Taken in 1973 in eight widely separated localities where sandy substrates were present; numerous in the sandy-bottomed moderately rapidly flowing water of ditch at Lake Road (fig. 2-C).

*Pimephales promelas* Rafinesque—Fathead Minnow

Present in 16 collections in 1973, ranging in numbers from few to abundant. Appears to be tolerant to moderate amounts of turbidity, and to siltation of substrates; less tolerant to increased stream flow, hence least numerous where channelization is most recent.

*Pimephales notatus* (Rafinesque)—Bluntnose Minnow

Present and well distributed in 15 collections in 1973. Usually somewhat less numerous than *Pimephales promelas*, less tolerant to turbidity, and more tolerant to increased stream flow.

*Camptostoma anomalum* (Rafinesque)—Stoneroller

Taken in eight collections, in widely distributed localities where riffles contained a clean substrate of sandy gravel and boulders.

*Carpiodes cyprinus* (Lesueur)—Quillback

Adults and/or small young taken in six collections in the deeper pools and an oxbow, usually

in small numbers. Migrates upstream from the Maumee River into Gordon Creek to spawn.

*Moxostoma duquesnei* (Lesueur)—Black Redhorse

In 1887, Meek's *Moxostoma duquesnei* was a composite of several species of suckers. The name has been restricted since to a species which normally inhabits clear streams with moderate to high gradients and substrates of clean gravel and sand. It should have been quite rare originally in the low-gradient streams of the Black Swamp (Trautman, 1957, p. 248). The *M. duquesnei* of Meek (1889) most probably were *M. erythrurum*, *M. valenciennesi*, and possibly an occasional *M. anisurum* (Silver Redhorse) and *M. macrolepidotum* (Northern Redhorse).

*Moxostoma erythrurum* (Rafinesque)—Golden Redhorse

Individuals of this species have been the most numerous *Moxostoma* inhabiting Ohio streams and they still remain well distributed. Undoubtedly this species was included in Meek's *M. duquesnei* and should have been common in the Maumee system in 1887. Its young were still numerous in the undredged portions in 1930, and adults have been observed more recently by members of the Ohio Division of Wildlife. We found none in 1973, despite careful investigation of the pools and riffles. This species is less tolerant to silty substrates than is *Catostomus commersoni*.

*Moxostoma valenciennesi* Jordon—Greater Redhorse

Only one specimen was taken in 1938 (Trautman, 1957, p. 257, fig. 48) and one in 1973, the latter a large adult. Presumably the species should have formed a fair proportion of Meek's *M. duquesnei*. As late as 1930, this species still remained well distributed throughout the Maumee River system (Trautman, 1957, p. 258), but was rapidly decreasing in numbers. The 1973 specimen was speared in the North Branch near Cicero, at the base of the Fort Wayne End Moraine, where the substrate was largely sand and gravel and there were well-defined riffles and pools. We seined several hundred yards of the stream, immediately after this individual was captured and again later, without seeing another specimen.

*Catostomus commersoni* (Lacépède)—Common White Sucker

Few to common in 13 collections in 1973, with small young sometimes abundant in deeper waters of dredged portions and wherever pools existed in undredged portions. Tolerant to silted substrates, turbidity, and low dissolved-oxygen. The *Catostomus teres* of Meek (1889, p. 436).

*Minytremma melanops* (Rafinesque)—Spotted Sucker

One individual was captured in Gordon Creek in the deeper, static waters occurring several yards upstream from its confluence with the Maumee River. Although Meek (1889) did not record this species, it must have been present, since it was well distributed in the Maumee system then, when there was less turbidity, little or no silting of the substrate, and some aquatic vegetation (Trautman, 1957, p. 275). It is usually a rather difficult species to capture.

*Erimyzon oblongus claviformis* (Girard)—Western Creek Chubsucker

One to several specimens taken in five widely scattered localities. It was captured in undredged portions of creek or in dredged portions which had recovered somewhat from ditching and dredging.

*Ictalurus natalis* (Lesueur)—Yellow Bullhead

Present only where undercut banks and/or piles of brush or living exposed tree roots provided concealment and where the adjacent substrate was mostly sand or sandy silt. One to more than 25 were taken in 10 collections, more than half of which were large adults.

*Ictalurus nebulosus* (Lesueur)—Brown Bullhead

Meek (1889) recorded this species as *Ameiurus nebulosus*. He may have captured some Brown Bullheads, but it appears more reasonable to assume that the majority of his specimens were *I. natalis*. He failed to record *A. natalis*, a species which should have been more numerous in 1887 than after 1929, because former conditions in the undredged stream were then far more favorable (Trautman, 1957, p. 421-23).

*Ictalurus melas* (Rafinesque)—Black Bullhead

Meek in 1887 reported *Ameiurus melas* as abundant. Between 1925 and 1938, Trautman found only one specimen in the recently dredged portions. It was uncommon or common in those stream sections which were undredged, or which after ditching had begun again to form static pools. This is a well-distributed bullhead in the Maumee drainage, and it is surprising that none was taken in 1973.

*Noturus flavus* Rafinesque—Stonecat Madtom

In 1973, one specimen was taken in a well-defined gravel-boulder riffle in Section 3, Crane Township, Paulding County. It seems strange that none had been taken previously.

*Noturus gyrinus* (Mitchill)—Tadpole Madtom

None has been taken since 1938. It is unknown why Meek in 1887 did not capture it, when its preferred habitat of clear non-flowing or slowly flowing waters and substrates of muck and organic debris were more prevalent than after dredging.

*Fundulus notatus* (Rafinesque)—Blackstripe Topminnow

Taken in 10 localities in 1973, but found in abundance only where there were both some

aquatic vegetation and a substrate of sand, as there were in the vicinity of Lake Road (fig. 2-C).

*Aphredoderus sayanus* (Gilliams)—Pirateperch

An inhabitant of clear static waters having a substrate of soft muck and organic debris, often associated with downed timber. This specialized habitat was early eliminated by ditching and draining. We expended much effort to find a suitable habitat, but were not successful in finding either the habitat or the fish.

*Poxomis annularis* Rafinesque—White Crappie

A few taken in 1930 and 1938 in static pools containing brush. During this period, the species was commonly stocked in Ohio waters.

*Micropterus dolomieu* Lacépède—Smallmouth Blackbass

Originally Gordon Creek was presumably too sluggish a stream for this species, although a few surely were present, at least in the warmer months. The Maumee River contained a large population wherever there were moving waters and a suitable gravel or bed-rock substrate. Meek (1889, p. 439) stated that, in the Maumee River adjacent to Gordon Creek, the species was "not very abundant." This statement is understandable when it is realized that by 1887 dams were preventing upstream spring migration (Trautman, 1957, p. 487). As late as 1935, there was a goodly population of Smallmouths around the rapids near Perrysburg.

*Micropterus salmoides* (Lacépède)—Largemouth Blackbass

Meek (1889, p. 439) reported that one specimen was taken on a "trout line" in the Maumee River and that then this species and the Smallmouth were "less common than formerly." The first individuals recorded were taken by members of the Ohio Division of Wildlife. As elsewhere throughout Ohio, hundreds of farm ponds were being built annually after 1940. The majority were stocked with Largemouths and Bluegills. Escapees during flooding appear to be the main reason for the recent more general distribution of both species in Ohio streams. During the 1973 surveys in Gordon Creek, one to four Largemouths were taken at six widely separated seining stations.

*Lepomis cyanellus* Rafinesque—Green Sunfish

Since 1887 the Green Sunfish apparently has been the most numerous sunfish species. It is tolerant to turbidity, siltation, and organic pollutants, but intolerant of recently channelized streams devoid of logs, brush, or pools.

*Lepomis macrochirus* Rafinesque—Bluegill Sunfish

As was true for the Largemouth Blackbass, the Bluegill was recorded in many streams throughout Ohio after the establishment of farm ponds, from which they presumably escaped into the streams. In 1973 the species was taken usually in small numbers, in places wherever pools had begun to develop.

*Lepomis humilis* (Girard)—Orangespotted Sunfish

This small species, a recent invader from Indiana, was not recorded in the Maumee drainage until 1929. It is very tolerant of turbidity and siltation, but not of recently channelized streams with their increased speed of flow and lack of pools.

*Lepomis megalotis* Cope—Longear Sunfish

Although present in 1887, when its habitat of clear pools, clean substrates, and some aquatic vegetation prevailed (Trautman, 1957, p. 514), Meek's (1889, p. 439) *Lepomis megalotis* may have been a composite of both it and *L. gibbosus*, especially since Meek did not record the latter in such a favorable habitat as Forlow's Pond.

*Lepomis gibbosus* (Linnaeus)—Pumpkinseed

This species may have been present in 1887, since it was present in the Maumee River drainage though unrecognized, as suggested above. It is an inhabitant of clear pools and ponds having some aquatic vegetation. Its presence since 1954 may be the result of escapes from farm ponds.

*Percina maculata* (Girard)—Blackside Darter

Recorded as rare to very common since 1887. In 1973 from one to 16 individuals were taken in five collections, always in flowing waters with a firm gravel-and-boulder substrate, or where the banks were undercut, offering hiding places. Meek's (1889, p. 440) *Etheostoma aspro* was this species.

*Percina caprodes* (Rafinesque)—Logperch

Three individuals of this species were captured in 1973 in Gordon Creek near its confluence with the Maumee River. This species normally inhabits moderate- or large-sized streams.

*Etheostoma nigrum* Rafinesque—Johnny Darter

Present in flowing waters wherever the substrate is of sand, gravel, and/or boulders. Abundant wherever the substrate is of sand that is being rapidly deposited possibly together with nutrients from the eroding fields.

*Etheostoma blennioides* Rafinesque—Greenside Darter

A few individuals were first recorded in 1930. The species usually inhabits higher gradient streams with well-defined riffles. It is intolerant to a silt-covered substrate.

*Etheostoma spectabile* (Agassiz)—Orangethroat Darter

This species was not recorded until 1973, when it was captured in eight localities. It was very common in well-defined riffles with sandy-gravel substrates, such as were present in the headwaters (fig. 3-A). The one specimen of *Etheostoma caeruleum* taken by Meek (1889,

p. 440) probably was *E. spectabile*, because at that time *E. caeruleum* and *E. spectabile* were not considered specifically distinct. There is no satisfactory record of *E. caeruleum* in that section of the Maumee system (Trautman, 1957, p. 594).

Several changes in the fish fauna of Gordon Creek have occurred since Seth Meek's original investigations in 1887. With few exceptions, most species have been affected in some manner; some have been extirpated, others still occur in greatly reduced numbers, and some have recently invaded the stream. The most obvious changes have been caused, to a greater or less degree, by ditching and other forms of channelization. There has been elimination, or reduction in numbers, of those species which require clear slowly flowing waters, pools, and/or rooted aquatic vegetation. These include the Central Mudminnow (*Umbra limi*), Grass Pickerel (*Esox americanus vermiculatus*), Goldenshiner (*Notemigonus crysoleucus*), Hornyhead Chub (*Nocomis biguttatus*), Mimic Shiner (*Notropis volucellus*), Tadpole Madtom (*Noturus gyrinus*), and Pirateperch (*Aphredoderus sayanus*). The elimination of well-defined riffles having a stabilized sandy-gravel substrate and constant current resulted in the extirpation, or reduction in abundance of the Golden Redhorse (*Moxostoma erythrum*) and Greater Redhorse (*Moxostoma valenciennesi*).

Species such as the Creek Chub (*Semotilus atromaculatus*), Common Shiner (*Notropis cornutus*), and Spotfin Shiner (*Notropis spilopterus*), which are tolerant to a more or less uniform current, such as is produced by channelization, have remained abundant, apparently irrespective of the type of substrate. Most of these species inhabit brooks and small streams. The Silverjaw Minnow (*Ericymba buccata*) and Johnny Darter (*Etheostoma nigrum*) were taken in greatest numbers where there was a gravelly-sand substrate. The Common Sucker (*Catostomus commersoni*), Carp (*Cyprinus carpio*), Fathead Minnow (*Pimephales promelas*), Bluntnose Minnow (*Pimephales notatus*), Yellow Bullhead (*Ictalurus natalis*), and Green Sunfish (*Lepomis cyanellus*) occurred most numerous in well-defined pools that were with or without currents, with or without undercut banks, fallen timbers and brush heaps, and with various types of substrates.

It is fully understood that the present conditions of the fauna and flora of Gordon Creek are not entirely the result of ditching and channelization, but are the combined results of these and other factors, such as the erection of dams, siltation, nutriment enrichments, and other pollutants, forest removal, increased erosion and general disturbance by man. In the future it may be difficult to correct or modify that which has been done in the past, but correction will be increasingly difficult if drastic channelization is continued.

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